Burden of Proof: Economic Analysis

- Burden of proof is often placed on the party who has readier access to knowledge about the fact in question.
- The design of burden of proof can be seen as a device for minimizing the costs of litigation.
- When optimally applied, it minimizes the expenditures devoted to gathering, processing, and presenting information during litigation.
Model

- Plaintiff (P) and defendant (D) contest over whether an even X has occurred (P says yes, D says no).
- D is liable if X does occur.
- Both parties have access to evidence that indicates (to the level of required certainty) whether X occurs.
- Evidence is binary; i.e., reveals all or nothing.
- Cost of presenting evidence is low, relative to damage.
Alternative Assignments of Burden of Proof

- **When P has burden of proof:**
  - P’s optimal strategy: presents evidence iff it indicates X occurs
  - D’s dominant strategy is not to present evidence
- **When D has burden of proof:**
  - P’s dominant strategy: presents no evidence
  - D’s optimal strategy: presents evidence iff it indicates X does not occur
- **In summary:** A party having the burden of proof will present evidence if it is in his favor; and the other party will not present evidence
Optimal Burden Assignment

• Given the optimal strategy described, the optimal assignment of burden of proof will be to compare

\[ \text{Prob}(X)C_p \text{ vs. } \text{Prob}(\sim X)C_d, \quad (1) \]

where \( C_p \) and \( C_d \) are the costs for P and D to present evidence, respectively.

• P (D) should bear the burden of proof iff LHS (RHS) of (1) is smaller
Further Considerations I: Settlement

- When there is possibility of settlement:
  1. If X has actually occurred, placing burden of proof on D saves the cost of P’s presenting evidence
  2. If X has not occurred, placing burden of proof on P saves the cost of D’s presenting evidence
- Court does not know whether X has occurred, and thus must compute probability
Further Considerations II:
Primary Behavior

- What if the occurrence of X is affected by the action of one party?
- Let $e$ be the cost of taking care
- $P_L = \text{Prob}(X \text{ occurs} \mid D \text{ takes care})$
- $P_H = \text{Prob}(X \text{ occurs} \mid D \text{ does not take care})$
- $L : P$’s loss when X occurs
- $A1: e < (P_H - P_L)L$: Socially efficient to take care
- $A2: C_p < E, C_d < L$
Further Considerations II: Primary Behavior

- If P has burden of proof, then he presents evidence if X occurs.
- D’s cost of being negligent is $P_H L$.
- D will take care if

$$e < (P_H - P_L)L,$$

which is implied by A1.
Further Considerations II: Primary Behavior

- If D has the burden of proof, then he presents evidence if X does not occur, and he is not negligent. If he is negligent, he will be held liable for sure.

- D will thus take care if

\[ e + P_L C_d < P_H L, \]

which is implied by A1+A2.
Further Considerations II: Primary Behavior

- Lesson: If the standard of care is efficient, then allocation of burden of proof will not affect defendant’s decision to take care.

Implying

1. the court only need to focus on its effect of litigation lost when searching for optimal burden of proof;
2. the court can take $\text{Prob}(X)$ as fixed when calculating the cost mentioned above.
Further Considerations III: Indirect Evidence

- If the evidence is proposed by way of another fact Y.
- Y is related to X.
- E.g.:
  - \(X \equiv \) Driver’s failure to exercise due care
  - \(Y \equiv \) Finding an empty beer bottle in car
- Bayes’ rule

\[
\begin{align*}
Prob(X \mid Y) &= \frac{Prob(X \text{ and } Y)}{Prob(Y)} = \frac{Prob(Y \mid X)Prob(X)}{Prob(Y)} , \\
Prob(\sim X \mid Y) &= \frac{Prob(\sim X \text{ and } Y)}{Prob(Y)} = \frac{Prob(Y \mid \sim X)Prob(\sim X)}{Prob(Y)}
\end{align*}
\]
Further Considerations III: Indirect Evidence

- Criterion (1) can be rewritten as

$$\text{Prob}(Y | X)\text{Prob}(X) \times C_p \quad \text{vs.}$$

$$\text{Prob}(Y | \sim X)\text{Prob}(\sim X) \times C_d$$ \quad (2)

- This gives a rough general rule on who should bear the burden of proof

- For example, if given $X$, it is very unlikely to observe $Y$, then $P$ should have the burden of proof.
How is the Proof Standard Determined?

- **Type I error:** Incorrect rejection of a true null hypothesis (false positive)
- **Type II error:** Incorrectly retaining a false null hypothesis (false negative)
- **Example:** Suppose null hypothesis is that one has not contracted a disease. When a medical test shows a positive reaction (i.e., shows disease has been contracted) when in fact patient has not, then it commits a Type I error. If the test shows negative reaction when patient actually has, it commits a Type II error.
How is the Proof Standard Determined?

- Suppose evidence is collected to show whether a man is guilty of a crime.
- The null hypothesis is that the man is innocent.
- Type I error is the error that the man is deemed guilty when he is actually innocent.
- Type II error is the error that the man is deemed innocent when he is actually guilty.
- Let $L_1$ and $L_2$ be the costs of type I and II errors, respectively.
How is the Proof Standard Determined?

- The collection and presentation of evidence can be thought of collecting an evidence $y$ on the “degree” of how guilty the man is:

- The greater the value of proof standard $x$, the greater (smaller) the type II (I) error.
How is the Proof Standard Determined?

- Let $p_1(x)$ and $p_2(x)$ be the conditional probability of committing type I and II errors, when standard of proof is $x$.
- The values of $p_1(x)$ and $p_2(x)$ depend on standard of proof in an intuitive way.
How is the Proof Standard Determined?

- The greater the value of \( x \), the smaller will be the value of \( p_1(x) \), and greater the value of \( p_2(x) \). That is, \( p_1'(x) < 0 \) and \( p_2'(x) > 0 \).
- Also assume \( p_2''(x) > 0, p_1''(x) > 0 \). (Errors are increasingly serious.)
- Expected social cost is then

\[
Prob(I)p_1(x)L_1 + Prob(G)p_2(x)L_2 \equiv C(x).
\]

- The aim of the legal system is to choose the standard of proof, \( x \), to minimize \( C(x) \).
- The optimal standard of proof, \( x^* \), satisfies

\[
p_1'(x)Prob(I)L_1 + p_2'(x)Prob(G)L_2 = 0.
\]
How is the Proof Standard Determined?

\[-p'_1(x) \text{Prob}(I)L_1 \quad \text{with} \quad p'_2(x) \text{Prob}(G)L_2\]
How is the Proof Standard Determined?

- Alternative, but identical, representation:
How is the Proof Standard Determined?

- The proof standard $x^*$ will be higher when
  1. $L_1$ is greater
  2. $L_2$ is smaller
  3. $\text{Prob}(I)$ is greater
  4. $\text{Prob}(G)$ is smaller